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CICADAS OF THE GENERA OKANAGANA, TIBICINOIDES AND OKANAGODES, WITH DESCRIPTIONS OF SEVERAL NEW SPECIES.

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The genus *Okanagana* probably contains more species of cicadas than any other in North America, and they are also in many instances quite hard to separate. In the northeastern part of the continent there appear to be only two species, but in the central and western parts it is far otherwise, and in California they are very numerous. As a rule the individuals of the same species resemble one another quite closely in color pattern, but occasional variation is seen, especially when the species is rather widely distributed. In his Preliminary Review of the West Coast Cicadidæ, published in the JOURNAL OF THE N. Y. ENTOMOLOGICAL SOCIETY, March, 1915, Mr. E. P. Van Duzee states that the "structural characters are very few in some of the genera, notably *Okanagana*, and I have been obliged to fall back upon color characters in the preparation of the key. The color and markings, while variable in extent, are quite constant in general facies for each species." A considerable number of species have been made known since 1915, but it will be some time before our collections are sufficiently complete to warrant the statement as to the exact number.

In considering the genus *Okanagana* it became necessary to first

identity Say's *Cicada* rimosa, described in 1830, and designated as the type of his genus *Okanagana* by Mr. Distant in 1905. We hope that we have successfully accomplished this, and the conclusions reached are to be found in the remarks on *rimosa.*

The original description of the genus *Okanagana* was published in the Annals and Magazine of Natural History, Seventh Series, Volume XVI, pp. 23, 190, 1905, and is as follows: "Head (including eyes) considerably narrower than base of mesonotum and almost equal to its length (including cruciform elevation); front shorter than vertex, its apex more or less emarginate, vertex centrally sulcate; pronotum about as long as head, its anterior angles in a line with eyes, its posterior angles dilated; abdomen in male longer, in female about as long as space between apex of head and base of cruciform elevation; tympana completely exposed, tympanal coverings entirely absent; face more or less centrally sulcate; rostrum reaching the intermediate coxæ; opercula small, transverse; abdomen beneath with the lateral margins broadly recurved; tegmina and wings hyaline; tegmina with the basal cell about or almost twice as long as broad, apical areas eight; wings with six apical areas. Type, *O. rimosa* Say (*Cicada*)."

The genus *Tibicinoides* was described by Mr. Distant in the Annals and Magazine of Natural History, Series 8, Vol. XIV, p. 166, Aug., 1914, and Uhler's *Tibicen cupreo-sparsus* was designated as type. Some of the characters mentioned are "tegmina and wings semiopaque; tegmina with the basal cell about twice as long as broad; apical areas short in length, eight in number, a curved rudimentary vein, curved inwardly, crossing tegmen from base of first ulnar area to base of lower apical area; posterior tibiæ with a few fine spines." While the fore wings in *Okanagana mercedita* and *O. minuta* are not colored as in *cupreo-sparsus,* the short apical areas show the three species to be related, and they may in the future be placed in the genus *Tibicinoides* as indicated in the table.

Owing to the length of the marginal cells Uhler's *Cicada hesperia* has been placed in the table near *striatipes* and *utahensis,* which it also resembles in some other features, instead of in the genus *Tibicinoides,* where its color pattern would place it.

In the table for the separation of species the natural sequence could not be followed in every instance, but we hope that it will serve to identify the members of this difficult group. In order to study these Cicadas the specimens should be spread so that the venation, the character of the basal cell of the fore wing and the color of the basal membranes can be seen. If the wings on one side, preferably the left, are expanded, it will suffice. Cicadas dry very quickly on the stretching board and freshly captured individuals need remain thereon only about a week, and those that have been relaxed in a softening box a still shorter time. In *Tibicen*, *Cacama* and most of the other genera of North American cicadas the uncus is withdrawn by the insect into the abdomen, but in *Okanagana*, *Tibicinoides*, *Clidophleps* and *Platypadia* it is always exposed. Often it can be fully examined without changing its position, but if the end be bent downward and concealed by the valve, the uncus should be lifted upward when the insect is mounted on the stretching board. A portion of a match can be inserted with a forceps between the uncus and the valve until the parts are dry, or the uncus may be simply lifted up with a pin.

I have received important material from the following named persons; other acknowledgments are made in connection with the specimens recorded:

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LIST OF SPECIES.

Okanagana.

cruentifera (Uhler)
magnifica Davis
mariposa Davis
vandykei Van Duzee
lurida Davis
ornata Van Duzee
napa Davis
schaefferi Davis
occidentalis (Walker)
bella Davis
rimosa (Say)
canadensis (Provancher)
tristis Van Duzee
arctostaphylæ Van Duzee
canescens Van Duzee
viridis Davis
aurantiaca Davis
fratercula Davis
oregona Davis
triangulata Davis
synodica (Say)
balli Davis
rubrovenosa Davis
vanduzeei Distant
vanduzeei var. *consobrina* Distant
vanduzeei var. *californica* Distant
striatipes (Haldeman)
utahensis Davis
hesperia (Uhler)
pallidula Davis
uncinata Van Duzee
mercedita Davis
minuta Davis
(Males not known.)
hirsuta Davis
rotundifrons Davis

Tibicinoides.

cupreo-sparsus (Uhler)

Okanagodes.

gracilis Davis

KEY TO THE SPECIES OF THE GENERA OKANAGANA AND TIBICINOIDES.

A. Male uncus not hooked at extremity, sometimes sinuate.

B. Expanse of fore wings more than 50 mm.

C. Base of fore and hind wings orange red more or less variegated with black.

D. Outer edge of fore wings forming a somewhat straight line. Very large species.

Pronotum all black; mesonotum with orange, discal spots; front margin of fore wings bright orange to end of radial cell, slightly darker beyond; venation not thickened; blood-red at base of both pairs of wings; notch in last ventral segment of female double. Expands 70–75 mm. ..... **cruentifera** (Uhler)

Pronotum all black; mesonotum black except at sides; front margin of fore wings bright orange to first marginal cell; venation thickened, especially about the marginal cells; notch in last ventral segment of female simple. Expands about 80 mm. .. **magnifica** new species

Pronotum narrowly edged on sides and posterior margins with rufus; venation not at all thickened. Expands about 75 mm. ..... **mariposa** Davis

DD. Outer edge of front wing of a more continuous curve. Medium sized species, except *schaefferi*, which is large.

E. Legs almost entirely orange or greenish in color. Abdomen pale beneath including the rather long valve.

Pronotum mostly pale with a black median vitta gemmate anteriorly, the lateral oblique groves more or less broadly black. Two broad pale marks extending from the anterior extremities of the mesonotal × ; a rather dull colored species with the uncus deeply cleft at extremity. Expands about 70 mm. .....**vandykei** Van Duzee

Pronotum as in *Vandykei;* mesonotum reddish straw color, black centrally; tergum black with posterior edge of the segments pale. A shining species with the uncus seen from above shallowly noticed at the extremity, and sinuate on lower margin when seen in profile. Expands a little over 60 mm. .....**lurida** new species

Head, pronotum and mesonotum almost entirely black, front margin of fore wing bright orange to the end of radial cell; basal cell opaque. Expands about 60 mm. .....**ornata** Van D.

Head, pronotum and mesonotum black, much variegated with dull orange; venation of fore wings uniformly light in color, basal cell clear; tergum shining black with the segments narrowly margined with orange posteriorly. A larger headed species than the last, and with a shorter uncus. Expands about 60 mm. .....**napa** new species

EE. Legs, especially the front pair considerably blackened.

F. Shining species with rather broad wings, and the hind margin of pronotum orange or reddish.

Front of head strongly produced; pronotum edged on sides and hind margin with orange, hind margin of abdominal segments both above and beneath orange. Last segments of abdomen beneath with short scattered pubescence. Expands about 75 mm. (Except in size this and *fratercula* resemble each other, and some specimens that may belong to the last named species are much larger than the type.)....**schaefferi** Davis

Venation of the fore wings fuscous, except the costal margin, which is often narrowly edged with black, but otherwise greenish-

orange to the end of the radial cell; subcostal vein black. Basal cell clear or nearly so. Pronotum edged on hind margin and at posterior angles and sometimes narrowly on sides with greenish-orange. Head small rather blunt in front, and proportionately broader than in the next species, very hairy on dorsal surface and with a considerable amount of rather long hairs behind the eyes; beneath thickly clothed with whitish hairs. Last ventral segment of female doubly notched. Expands about 60 mm. .....**occidentalis** Walker

Of a slightly blueish tint, otherwise colored about as in the last species, but the costal margin of the fore wings to the end of the radial cell often bright orange, the basal cell clouded sometimes blackened. Pronotum usually plainly edged with orange on sides as well as on hind margin. Head not as blunt when viewed from above as in *occidentalis,* proportionately narrower and with little hair behind the eyes, also less hairy beneath. Last ventral segment of female not doubly notched, or second notch but feebly indicated. Expands about 60 mm. .....**bella** new species

FF. Dull bodied species or at most feebly shining, with proportionately narrower wings, and the hind margin of pronotum orange or reddish, except in *tristis* where it is black. Dorsum of the abdomen often with conspicuous transverse rows of short silvery hairs.

Basal cell of fore wings slightly clouded, pronotum blackish mottled each side with testaceous, the hind margin and sides reddish. Tergum with the posterior edges of the segments reddish, the vestiture more sparse than in *canadensis* and more in the nature of hairs. Expands about 60 mm.

rimosa (Say)

Venation of the fore wings often thickened; basal cell clouded and blackened. Pronotum usually entirely black, except the hind margin which is testaceous, sometimes

clouded each side with reddish; tergum black with much tomentum, which when removed leaves a smooth surface. A black species with the usual four orange spots before the mesonotal ×, and orange membranes at the base of both pairs of wings. Expands about 62 mm.

canadensis (Provancher)

Venation about as in *canadensis*, but the veins not thickened. Pronotum generally all black, but sometimes mottled with dull red each side of the center. Further distinguished from the other two species in this section by having the abdomen beneath centrally pale. Expands about 70 mm.

tristis Van D.

CC. Base of the fore and hind wings not of the usual orange red variegated with black.

Color rufo-ferruginous including the venation of fore and hind wings, with a few marks on the vertex and a dorsal vitta on the tergum black. Expands about 70 mm.

arctostaphylæ Van D.

Body almost entirely black; basal cell of the fore wings clear; membranes at base of both pairs of wings whitish. Expands about 65 mm. .....**canescens** Van D.

Body and wing venation nearly entirely green: basal cell of fore wings clear. Expands 65 mm. .....**viridis** Davis

Body and wing venation nearly entirely orange; basal cell of fore wings clear; a black band between the eyes, and a conspicuous dorsal band of the same color extending from the hind margin of the pronotum to the end of the abdomen. Expands about 55 mm. ....**aurantiaca** Davis

BB. Expanse of fore wings 50 mm. or less; orange variegated with black at base of both pairs of wings. (Some examples of *fratercula* exceed 50 mm.)

G. Pronotum in mature individuals black centrally margined with orange especially behind. In *triangulata* the grooves of the pronotum are sometimes orange colored.

Basal cell of fore wings darkly opaque, abdomen black beneath with hind margins of segments reddish. A dark colored species. Expands about 47 mm. **fratercula** Davis

Basal cell and venation of fore wings yellowish; abdomen yellowish beneath with numerous silken hairs; front of head and eyes not prominent. Expands about 50 mm.

oregona Davis

Basal cell of fore wings translucent; abdomen yellowish be-

neath with silken hairs very short or absent; front of head and eyes prominent. Expands about 50 mm.

triangulata Davis

GG. Pronotum in mature individuals black with the central portions variegated with orange or yellow. Basal cell of fore wings yellowish or translucent.

Head small, front prominent; discal yellow marks extending from the mesonotal × to the front margin of the mesonotum. The veins surrounding the first seven marginal cells of fore wing infuscated. Expands about 42 mm.

synodica (Say)

Membranes at base of fore and hind wings pinkish, remainder of wing venation yellowish. The W mark on the front portion of the mesonotum separated from the mesonotal ×; tergum darker, the terminal segments nearly all yellow as in *synodica*. Expands about 46 mm.

balli new species

AA. Male uncus hooked at extremity.

B. Rather slender bodied species with the venation of fore and hind wings colored almost uniformly throughout.

Black clothed with minute dark rufus hairs giving the insect a dull reddish aspect. Expands about 55 mm.

rubrovenosa Davis

BB. Stouter bodied species, the fore and hind wings variegated with orange and black at the base.

C. Third marginal cell more than one half as long as second ulnar area adjoining and immediately behind it.

D. Expand about 55 to 60 mm. Black species with basal portions of fore and hind wings orange variegated with black.

E. Front of head not conspicuously produced; under side of abdomen with very numerous long silken hairs.

F. Abdomen black above or nearly so in var. *californica*.

Almost wholly black above, pronotum dull rufus, particularly on the sides; abdomen beneath with the central area black, except the reddish or yellowish posterior margin of each segment; valve black on under side. Expands about 60 mm.

vanduzeei Distant

Dorsal markings much lighter, especially about the mesonotal ×; abdomen beneath with a black spot on each segment except

the last. Expands about 55 or 60 mm.
vanduzeei var. **consobrina** Distant

Dorsal markings of the pronotum still more extended and confluent; beneath, abdomen almost entirely yellowish, valve yellowish. Expands about 57 mm.
vanduzeei var. **californica** Distant

EE. Front of head conspicuously produced; silken hairs on under side of abdomen short and inconspicuous.

Dorsal surface with much appressed golden pubescence; abdomen black and yellowish above, and usually entirely yellowish beneath. Basal cell usually transparent. Expands about 53 mm.
striatipes (Haldeman)

Dorsal surface with the hairs more upright than in *striatipes,* which it much resembles in markings. Dorsum of abdomen black, beneath central area usually black with hind margins of segments reddish. Basal cell darkened. Expands about 60 mm. ....**utahensis** new species

DD. Expand about 52 mm., usually much less.

G. Fore and hind wings, except marginal cells, infuscated. Uncus when viewed from behind with hook terminating in a broadly rounded notch. Expands about 52 mm.....**hesperia** (Uhler)

GG. Fore and hind wings clear except at extreme base, where the membranes are orange.

Yellowish or yellowish green; front conical and prominent. Expands about 50 mm.
pallidula Davis

Smaller and darker than the last; head small; front not so prominent. Venation approaching the next two species. Expands about 42 mm.
uncinata Van Duzee

CC. Marginal cells short; the third one in fore wings about one half as long as second ulnar area adjoining and immediately behind it.

H. Both pairs of wings clear except near base.

Head including eyes about 5 mm. broad. Expands about 40 mm. .....**mercedita** Davis

Head including eyes about 4 mm. broad. Expands about 35 mm. .....**minuta** Davis

HH. Both pairs of wings clouded, particularly the basal half of front pair.

Head including eyes about 4.5 mm. broad, membranes

at base of both pairs of wings vermilion; tergum black. Expands about 34 mm.

Tibicinoides cupreo-sparsus (Uhler)

In addition to the species mentioned in the key there are two others of which only the female sex is known. *Okanagana hirsuta* Davis was described and figured in the JOURNAL OF THE N. Y. ENTOMOLOGICAL SOCIETY for March, 1915, from a specimen in the collection of the American Museum of Natural History, labeled Santa Rosa Island, California. It expands about 80 mm., and resembles a greatly enlarged *vanduzeei,* but it is even more hairy beneath than in that species; the front of the head is not quite as rounded, and the basal cell of the fore wing is clear instead of clouded as in *vanduzeei.* Unfortunately in the original description the width of the fore wing in *hirsuta* is printed 7 instead of 11 mm. The insect is shown correctly in the figure.

Okanagana rotundifrons Davis was described and figured in the JOURNAL OF THE N. Y. ENTOMOLOGICAL SOCIETY for September, 1916, from a female in the collection of the University of Kansas taken in Arizona. It expands 71 mm., and is a shining black and yellowish species, with a conspicuously blunt and rounded front.

Okanagana cruentifera (Uhler). Pl. xix, fig. 2.
1892. Trans. Md. Acad. Sci., i, p. 161.

In the United States National Museum there is a female from "F. H. Hillman, Reno, Nev. 6, 21, 1890," labeled "*Tibicen cruentifera* Uhler, Cotype from Uhler's Coll." in the handwriting of Mr. Heidemann. No label by Uhler is on the specimen. It is spread; expands 75 mm., with the front of the head quite prominent, and the notch in the last ventral segment double. According to the original description all of the cotypes came from Nevada. Another specimen in the Uhler collection, captured after *cruentifera* had been described, is labeled "F. H. Hillman, Reno, Nev. 7, 3, 98," and identified as "*Tibicen cruentifera* Uhler, Nev." in Uhler's handwriting. This is a spread specimen, expands 78 mm.; front is prominent; the pronotum is almost entirely black, with a hair line of red along the hind margin; venation about the marginal cells not clouded.

A male in the U. S. National Museum is labeled simply "Nev.," and on a separate label "P. R. Uhler collection." This may be one

of the cotypes. It expands nearly 70 mm.; head and pronotum entirely black, grooves containing much pubescence; mesonotum with the usual discal reddish spots, hind margin red; tergum with posterior margins of the segments red; fore wings with the costal margin orange to the end of the radial cell, darker beyond; first and second cross veins not infuscated; basal cell clouded; mebranes at base of both pairs of wings of a bright red. Beneath femora dull red variegated with black especially at the ends; under side of abdomen black with the posterior margin of each segment rather broadly and unevenly margined with red; valve light colored. We present a figure of this specimen.

In the American Museum of Natural History there are three females from Nevada, one of them labeled Virginia City, like the one described above. They expand from 70 to 75 mm.

Lately we have received a female collected June 25, 1919, and a male collected June 27, 1919, at Coal Creek, Iron Co., Utah, by Mr. Tom Spalding.

Four males labeled Los Angeles Co., Cal., July, Collection Coquillet, are in the United States National Museum and are like the Nevada male described above. Two males from Nellie, Calif., June 20 and 24, 1918 (E. P. Hewlett), are in the writer's collection and are darker than the other specimens here mentioned, with the costal margin of the fore wings not as brightly colored and edged with a narrow line of black. The membranes of both pairs of wings are blood red at base as in true *cruentifera*. The tergum is nearly all black, while beneath the abdomen and valve are shining red, the former blackened along the sides and at base. Expand 70 mm. This seems to be a variety of *cruentifera*.

Okanagana magnifica new species. Pl. xix, fig. 1.

Type male from Jemez Springs, New Mexico, June 4, 1918 (John Woodgate), and allotype female from same place, July 1, 1918. Davis collection.

Resembles *O. cruentifera*, but is larger and has differently shaped uncus.

Head slightly narrower than the front margin of the pronotum; front moderately protruding and covered with long grayish hair, face also very hairy. Median sulcus of the front well defined. Pronotum with the humeral

angles rounded, the anterior angles not very prominent and almost hidden by long hairs from behind the eyes and growing on the pronotum itself. Last ventral segment slightly constricted at the sides, then broadened out to the extremity, which has the outer angles rounded; not sinuate at extremity. Uncus when viewed in profile elevated centrally with a slight sinuation near

OKANAGANA MAGNIFICA

the lower extremity; when viewed from behind, notched at the extremity, and more deeply so than in *cruentifera*. The valve in the male is long and orange in color. The last ventral segment in the allotype is simply and broadly notched; the notch is double in *cruentifera*. Fore wings with the costal margin bright orange nearly to the extremity of the wings, the remaining veins fuscous, somewhat thickened and clouded at the marginal cells; basal cell blackened; membranes at base of both pairs of wings of the brightest orange; not blood-red as in *cruentifera*. Head entirely black; in some of the paratypes the antennæ are marked with orange on the basal joint. Pronotum entirely black in the type; in the allotype it is very narrowly edged posteriorly with red. Mesonotum red at the sides, otherwise black including the ×. Metanotum edged posteriorly with red. Tergum black with the first six segments edged with red at extreme lower part of the sides only, segments seven to nine edged completely on the posterior margin with red. Beneath the body including the legs hairy; the legs are orange-red striped with black and the abdominal segments more evenly edged posteriorly with orange-red than in *cruentifera*.

MEASUREMENTS IN MILLIMETERS.

	Male Type.	Female Allotype.
Length of body	35	31
Width of head across eyes	9	9
Expanse of fore wings	84	84
Length of valve	8	

In addition to the type and allotype I have received sixty-two males and eighty-nine females collected at Jemez Springs, New Mexico by John Woodgate at 6,400 ft. to 7,500 ft. elevation, June 2 to July 2, 1918. They were most common about the middle of June. Mr. Woodgate writes that the "Navajo children tear the legs and wings off of the cicadas and eat them—say they taste like pecan nuts."

The species must have been quite plentiful in 1918 in parts of New Mexico, for Mr. Warren Knaus sent me a male and female collected about four miles southeast of Santa Fe, on the old Santa Fe trail on scrub pine and cedar, June 15, at an altitude of about 7,000 feet. In 1919 Mr. Woodgate collected seventy-eight specimens of this species at Jemez Springs. Mohave Co., Arizona, 1919, 3 males, 4 females.

In the United States Natural Museum there is a male *magnifica* labeled "*Tibicen cruentifera* Uhler var. Uhler," from "E. A. Bush, San Jose, Cal., Aug. 2, 1887." Evidently Uhler himself considered this not a true *cruentifera*. Two other specimens are as follows: a female from "Nordhoff, Cal., 4, 6, 1905, W. M. Slosson," expands 88 mm., last ventral segment with notch simple; male "From W. M. Slosson, Nordhoff, Cal., June 4, 1905, found on pinon trees near the west end of San Emedio Mts., Cal." The male bears a further label by Mr. Heidemann, "*Tibicen cruentifera* Uhler var." Also in the U. S. National Museum there is a female from "Nucla, Col. Ch. T. Trueb, Sept. 7, '09," with a slightly smaller head than the Nordhoff female. It expands 88 mm. and the last ventral segment is simply notched. It is labeled "*Fidicina cruentifera* Uhler, O. H."

Okanagana mariposa Davis.

1915. Journal N. Y. Ento. Soc., xxiii, p. 12, pl. 3, fig. 2.

The type of this species came from Mariposa Co., California, June 16, 1914. In the collection of the United States National Museum there is a male also from Mariposa Co., Calif. It has been compared with the type and is like it in every particular, except that it is larger, expanding 90 mm. Lately Dr. F. E. Blaisdell has sent to me two males and a female collected by him at Hullville, Lake Co., Calif., June 13, 1917. The female is the first one I have seen and is colored, as are the two males, almost exactly as in the male type. The size is very nearly the same. Beneath the notch in the last ventral segment is remarkable for its great breadth; at its central portion there

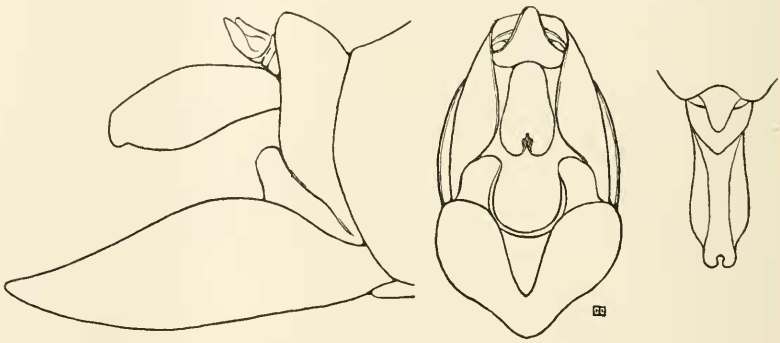
is a minute sinuation just opposite the ovipositor. The straight outer margin of the fore wings and the broad head with slightly protruding front, are conspicuous features of this large species.

A male and female collected at Bellevue, Washington Co., Utah, June 21, 1919 (Tom Spalding) are like the specimens examined from California.

Okanagana vandykei Van Duzee.

1915. Journal N. Y. Ento. Soc., xxiii, p. 38.

Reported in the original description from Carrville, Trinity Co., Calif., June 29, 1913; Nash Mine, Trinity Co., Calif., June 29, 1913, 8,000 ft., and Plumers Co. Calif., June. To these records may be added a female from Keddie, Plumas Co., Calif., June 7, 1918, 3,500 ft. (F. M. Jones), Davis collection. We have examined a male from



OKANAGANA VANDYKEI

Riddle, Oregon, June 18, which is like the paratype from Plumas Co., with the same long, orange colored valve, orange marks on pronotum, etc., except that the front is more prominent and black. A female from Forest Grove, Oregon, July 30, 1917 (Catherine Jones collector), has the body colored as usual, but the costal margin of the fore wings to the end of the radial cell is bright green instead of the more usual orange. The first anal vein is also bright green, and the basal cell is darkened along the hind margin.

Okanagana lurida new species. Pl. xix, fig. 3.

Type male from Pulman, Washington (C. V. Piper). Collection U. S. National Museum.

Resembles *Okanagana vandykei* in color but has less dark markings, and is more shining. The uncus is not as deeply cleft at extremity as in that species. It is probably generally smaller, judging from the type.

Head slightly narrower than the front margin of the pronotum;

OKANAGANA LURIDA

front moderately produced. Median sulcus of the front not very deep. Pronotum with the humeral angles rounded, the lateral edges rather rough and uneven, and the anterior angles prominent. Last ventral segment hardly constricted at the sides, but evenly narrowed to the extremity, which is almost truncate. Uncus when viewed in profile sinuate on lower part with the greatest depth beyond the center; when viewed from behind shallowly notched. Fore wings with the venation almost entirely straw colored; the veins about the marginal cells are fuscous, and the basal cell is clear or nearly so. The membranes at the base of both pairs of wings are bright orange. Head reddish straw-colored with a short irregular blackish mark each side of the central ocellus, and a blackish dot between each hind ocellus and the eye. Front and the transverse rugæ black. Pronotum reddish straw-colored with a central band, narrowest in the middle, black; also blackened irregularly in the grooves, and a submarginal black band posteriorly and on the sides. Mesonotum almost entirely reddish straw-colored; the region covered by the W mark blackened; and an irregular central black band extending from thence to the elevated ×, which is pale, but the adjoining depressions are black. Metanotum reddish straw-colored, with a submarginal blackened area. Tergum black, with each segment reddish strawcolored posteriorly.

The uncus is black. Beneath the legs are almost entirely light in color blackened at the knees, the abdominal segments are covered with much short hair; are reddish straw-colored margined anteriorly with red. In addition each segment has two dark colored basal blotches more or less connected, one each side of the center. The valve is dark colored on the lower surface, lighter near the upper margins, and when viewed in profile it does not extend as far beyond the end of the uncus as it does in *vandykei* and *ornata*.

MEASUREMENTS IN MILLIMETERS.

	Male Type.
Length of body	26
Width of head across eyes	7.5
Expanse of fore wings	62
Length of valve	5

Okanagana ornata Van Duzee.

1915. Journal, N. Y. Ento. Soc., xxiii, p. 33.

In the collection of the American Museum of Natural History there is a male labeled "Nevada." We have also examined a male from Hood River, Oregon, June 10, 1916, in the collection of the Oregon Agricultural College, and a female from Blue Canyon, Calif., June 7, 1909 (Ball), in the collection of Dr. E. D. Ball. In the writer's collection there are two males and one female from Sonoma Co., Calif., one of the former being the allotype of the species, and a male from Keddie, Plumas Co., Calif., June 28, 1918, 3,500 ft., collected by Mr. Frank M. Jones of Wilmington, Delaware, who kindly presented it to me. This is a very bright and contrastingly colored species. Mr. Van Duzee states "This species may be recognized by its black, almost immaculate upper surface with bright orange venation."

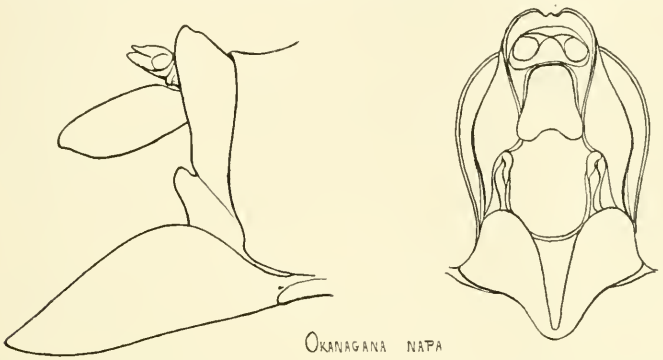
Okanagana napa new species. Pl. xix, fig. 4.

Type male from Napa County, Calif. (J. J. Rivers). Collection U. S. National Museum.

Resembles *Okanagana ornata* in size and in being shiny, but is lighter colored, has a larger head and a shorter uncus.

Head quite broad and nearly of the same width as the front margin of the pronotum; front not prominent; median sulcus well defined. Pronotum

with both the humeral and anterior angles rounded, the latter much more so than in either *lurida* or *ornata*. Last ventral segment gradually narrowed to the extremity which is sinuated with the angles much rounded. Uncus when viewed in profile short with the lower side much straighter than in *lurida;* when viewed from behind, shallowly notched. Fore wings with the venation almost entirely straw colored, slightly darkened about the marginal cells; the basal cell is clear. The membranes at the base of both pairs of wings are



orange, but these as well as the venation, lack the bright color of *ornata*. Head black with the grooves, front and the region of the transverse rugæ almost wholly dull orange. There is a broken black band consisting of four spots extending across the front, and the hollows between the transverse ridges are narrowly lined with fuscous. The terminal part of the rostrum is black, the base is pale. Pronotum black centrally, but margined all round except at the anterior angles with dull orange, and the orange of the grooves considerably spread. This leaves only the central part black, with some irregular black marks on the ridges between the grooves, and a submarginal black band along the sides and posterior margin. Mesonotum dull orange with four obconical black marks on the anterior margin, and a central spear-shaped mark extending toward the orange elevated ×. There is a black dot each side at the anterior extremities of the ×, also an interrupted black band extending each side from the × to the base of the fore wing. Metanotum edged posteriorly with orange. Tergum shining black, with the segments narrowly edged posteriorly with orange. The uncus is black. Beneath the legs are light colored except at the knees and the fore femora are somewhat blackened on the inner side; the abdomen is light, except the usual dark spot centrally near the base, and the valve is also light in color.

MEASUREMENTS IN MILLIMETERS.

	Male Type.
Length of body	24
Width of head across eyes	7.5
Expanse of fore wings	58
Length of valve	4.5

Okanagana schaefferi Davis.

1915. Journal N. Y. Ento. Soc., xxiii, p. 19, pl. 3, fig. 4.

This species was described from a single male in the collection of the Museum of the Brooklyn Institute of Arts and Sciences, from Iron Co., Utah, 1904. In June, 1917, Mr. George P. Engelhardt of the Brooklyn Museum collected a number of specimens in the foot hills of the Kolob Mts., Washington Co., Utah, and kindly gave me seventeen males and two females. Other specimens examined have been a male, Manti, Sampete Co., Utah, June 23, 1903, collection Dr. E. D. Ball, a male from Salida, Colorado, June, 1885, collection University of Nebraska, and a female from Jemez Springs, 6,400 ft., New Mexico, June 17, 1919 (J. Woodgate). A noticeable feature of this large insect is the strongly protruding front of the head.

Okanagana occidentalis (Walker).

1866. Walker in Lord's Naturalist in Vancouver Island and British Columbia, ii, p. 339.

This species was listed as a synonym of *rimosa* Say by Distant in his Synonymic Catalogue of Homoptera (1906), but it is distinct from that species, and from *Okanagana bella* described in this paper, which it more closely resembles. The most noticeable differences between these three species have been mentioned in the table, and in series *occidentalis* is not as blue-black as *bella,* and the pubescence on the upper surface is more abundant and more golden in color. The true *rimosa* is a duller colored insect, the tergum not shining as in *occidentalis* and *bella.* Walker's description is poor and we may be in error in applying it to this species. The description would also apply to some specimens of *vanduzeei* except that they are usually too small. He states that the body is, 12 lines in length, is black, and that the mesothorax has two V-shaped testaceous marks, "which extend from the fore border to the disk, and are distinct except at the tips." These V-shaped marks are commonly present in what we have called *occidentalis,* and the tips are usually well defined. In *bella* the V-shaped marks are obscure or absent.

John Keast Lord in The Naturalist in Vancouver Island and British Columbia, has this to say of this species: "But there was one sound—song perhaps, I may venture to call it—that was clearer, shriller and more singularly tuneful than any other. It never ap-

peared to cease, and it came from everywhere—from the tops of the trees, from the trembling leaves of the cottonwood, from the stunted underbrush, from the flowers, the rocks and boulders . . . all chanting the same refrain. . . . It turned out to be an entirely new species, and now figures in the British Museum as *Cicada occidentalis.*" Dr. Charles J. Gahan has written me under date of May 12, 1919, that this specimen cannot at the moment be located in the British Museum. It would appear from Lord's original narrative that the type locality for this species is in the north-eastern part of the present state of Washington in Colville Valley, where the Boundary Line Commission had its headquarters.

In the collection of the United States National Museum there is a female *occidentalis* from Victoria, Vancouver, H. G. Hubbard collector, which expands 70 mm. and is like many examples in the writer's collection; the last ventral segment is doubly notched and the basal cell in the fore wing is clear. From the collection of the University of Nebraska we have examined four males labeled British Columbia (G. W. Taylor). From the collection of the Dept. of Agri. Prov. of Nova Scotia, a male collected by W. Downes at Armstrong, B. C., July 12, 1915; and from the collection of H. H. Lyman, a female from North Bend, B. C., July 24, 1890. Prof. A. L. Lovett of the Oregon Agricultural College, has kindly sent the following material from the collection of that institution: Eureka, Wash., June 30, 1895, female; Rainier, Or., July, 1905, male (Thayer); Sauvier's Island, Or., June 8, 1906, male (Farrell); Dixie, Wash. Co., Or., July 31, 1907, male; Oswego, Or., June 5, 1904, female (Ewing), June 8, 1907, female (George Ewing), July 7, 1907, female (George Ewing); Willamina, Or., July 2, 1911, female; Philomath, Or., Aug. 14, 1906, female (Schrack); Corvallis, Or., June 2, 1906, male (Buchanan), June 12, male, July 10, 1896, male, Sept. 2, 1911, female, Sept. 9, 1906, male (Woods); Cascadia, Linn Co., Or., male, July 28, 1903 (Rosendorf), Aug. 1, 1903, male (Rosendorf). Two females from Dilley, Oregon, are in the writer's collection.

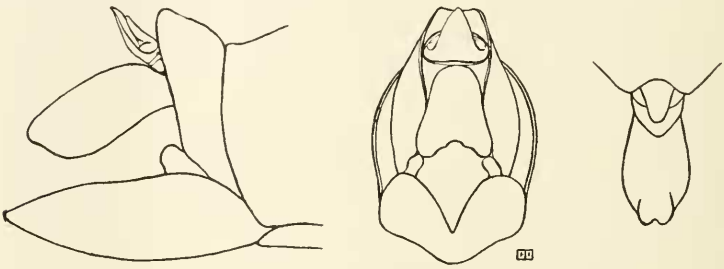
Mr. Otto Huellemann of Wallace, Idaho, has sent me 51 specimens of this species collected near his home, in the years 1915 to 1918 inclusive. Three were collected in May, eight in June, and forty in July. Judging from those received they were very plentiful in

July, 1917. The specimens of this long series are uniform in appearance, they are black above with the hind margin of the pronotum orange; four orange spots arranged in a semi-circle before the mesonotal $\times$, and the $\times$ itself with the elevated parts touched with orange. The basal cell of the fore wing is clear. The last ventral segment in the females is doubly notched.

Okanagana bella new species. Pl. xx, fig. 1.

Type male from Stockton, Utah, June, 1915, and allotype female from Soldiers' Canyon, Stockton, Utah, June 27, 1915 (Tom Spalding). Davis collection.

Resembles *Okanagana occidentalis,* but differs as indicated in the remarks on that species, and in the characters given in the table.



OKANAGANA BELLA.

Head rather small and not quite as broad as the front margin of the pronotum; front moderately produced; median sulcus well defined. Pronotum with the humeral angles rounded; the anterior angles prominent and slightly rounded. Sides of pronotum have a few irregular serrations. Last ventral segment longer than in *occidentalis,* and with the sides curved inward to the extremity which is rounded. In some specimens from southern Utah the extremity of the segment is slightly sinuate. Uncus when viewed in profile not hooked at extremity, short and slightly deeper beyond the middle; when viewed from behind, with a shallow notch at extremity. Last ventral segment of the allotype has a broad simple notch, but in some of the paratypes there is a slight indication of a second notch. Fore wings with the costa orange to the end of the radial cell, darker bekond; the subcostal vein is fuscous. Basal cell clouded; the remaining veins fuscous, except at the base of wing, which is orange; the membranes of both the fore and hind wings are vermilion. Head black with the supra-antennal plates and the grooves in front of the middle ocellus orange. The region of the transverse rugæ black bordered by orange. The rostrum is black, orange at base. Pro-

notum shining black, slightly bluish, with the sides and posterior margin orange; the front margin sometimes narrowly edged with orange. Mesonotum shining bluish black bordered on the sides posteriorly with orange. The elevated × has the fore limbs touched with orange, in front of which are the usual four orange spots arranged in a semi-circle. In some of the darker specimens from Oregon the mesonotum is more nearly black. Metanotum black edged posteriorly with orange. Tergum shining black, with the same slightly bluish tint of the parts already described; the segments very narrowly edged posteriorly with orange, the orange most conspicuous at the sides. In some of the Oregon specimens the tergum is nearly all black. Uncus black. Beneath, the legs are orange blackened at the joints and considerably blackened on the inner side of the fore femora. The abdominal segments are blackened centrally, orange on the posterior margins, also with a black spot on each segment at the sides. Valve black, sometimes orange at the sides along the upper margin. In some of the specimens from Colorado the valve is entirely orange.

MEASUREMENTS IN MILLIMETERS.

	Male Type.	Female Allotype.
Length of body	25	23
Width of head across eyes	6.5	7
Expanse of fore wings	58	62
Length of valve	5	

Some of the paratypes represent a darker race, blacker on the legs, and in the fore wings the costal margin is not as conspicuously orange.

This insect has generally been considered the *Cicada rimosa* of Say, but that species is duller colored and appears to be more eastern in its range.

The following specimens of *Okanagana bella* have been examined:

Utah.—Logan, June 10, 1904, male; July 4, 1904, two females; June 22, 1906, four males, two females; Logan Canyon, June 19, 1909, three males and two females; July 4, 1909, two females, from collection Dr. E. D. Ball. Garland, June 11, 1904, male; June 18, 1904, male and two females, collection Dr. Ball. Wellsville, July 3, 1904, female, collection Dr. Ball. Salt Lake City, June 8, 1902, male, and June 15, 1902, male, Davis collection; male and two females without date labels (Dr. Henry Skinner), collection Acad. Nat. Sci., Philadelphia. Silver Lake, July (Dr. Skinner), collection Acad. Nat. Sci., Philadelphia. Mill Creek, June 20, 1906, two females (E. G. Titus),

Dr. Ball collection. Stockton, June, 1915, three males (Tom Spalding), and Soldiers' Canyon, Stockton, June 27, 1915, three males and two females (Tom Spalding), Davis collection. Santaquin, male and two females (T. H. Parks), Davis collection. Provo, June 3, 1910, female; June 4, 1910, two males; June 24, 1912, two males and two females (Spalding), Davis collection. Eureka, June 19, 1910, female (Spalding), Davis collection. Nephi, June 25, 1912, male, collection Dr. Ball. Cedar Mountains, Iron Co., 8,500 ft., July 11, 1917, seven males (Geo. P. Engelhardt), Davis collection. Kolob Mountains, Washington Co., 8,500 ft., June 30, 1917, eight males (Geo. P. Engelhardt), Davis collection.

Kansas.—Male and female with no date label, collection Acad. Nat. Sciences, Philadelphia.

Colorado.—Livermore, July 8, 1900, two males, collection Dr. Ball. Ft. Collins, June 29, 1901, two males and three females, collection Dr. Ball. Estes Park, male, collection Univ. of Kansas. Golden, June 26, 1911, male (C. A. Frost), Davis collection. Russell, June 24, male (H. S. Smith), Davis collection. Creede, 8,844 ft., Aug., 1914, female (S. J. Hunter), collection Univ. of Kansas. Durango, August 1, 1912, male (Oslar), Davis collection.

New Mexico.—Hot Springs, San Miguel Co., 7,000 ft., August, 1882, female (F. H. Snow), collection Univ. of Kansas. Jemez Springs, June, 1916, two females; July 5, 1916, female; June 14, 1917, female; June 20, 1918, two females; June 15, 1919, female (John Woodgate), Davis collection. Albuquerque, August 14, 1910, female (Oslar), Davis collection.

Wyoming.—Newcastle, male and female, collection Univ. of Nebraska. Yellowstone National Park, June 20, 1907, male; June 30, 1907, female; July 9, 1907, female (Col. Wirt Robinson), Davis collection.

Montana.—Nigger Hill, Powell Co., July, female (W. M. Mann), Davis collection. Sedan, July 1, 1906, four males. Corvallis, July 14, 1908, male. Gallatin Co., June 16, 1902, male (R. A. Cooley), and July 1, 1915, male. Bozeman, 4,800 ft., July, 1901, male and female (E. J. S. Moore); July 3, 1905, male; July 3, 1906, male; July 20, 1907, female; June 20, 1912, three males. Paradise Valley, Park Co., July 9, 1904, male and female. Billings, July 10, 1912, female. Cul-

bertson, Valley Co., June 29, 1911, female (J. R. Parker). Enid, July 12, 1912, male. Miles City, Aug. 4, 1915, male. All of the Montana records, the first one excepted, are from specimens in the collection of the Montana Agricultural Experiment Station.

Idaho.—Whitebird, June 29, 1907, male (Dr. J. M. Aldrich). Moscow, June 13, 1911 (Dr. J. M. Aldrich). Both of these records are from specimens in the collection of the University of Idaho.

California.—El Dorado Co., July, 6,280 ft., male (Dr. F. E. Blaisdell). Monachee Meadows, Tulare Co., 8,000 ft., July 17, 1917, male (G. R. Pilate). Top of Mt. San Antonio, 10,000 ft., Southern Calif., June 29, 1914, female (H. Newcomb). San Antonio Canyon, Ontario, July 25, 1907, male and female, Coll. Ohio State Univ. In these and some of the Oregon examples the basal cell of the fore wings is almost entirely black.

Oregon.—Corvallis, July 18, 1896, male and female without date. Salem, June 30, 1911, female. Crooked River, central Oregon, June 23, 1906, five males, three females. Minam Nat. Forest, July 5, 1914, female (W. J. Chamberlin). Baker City, July 6, 1906, male, and July 12, male. The above Oregon records from specimens in the collection of the Oregon Agricultural College. The following two from the collection of the U. S. Biological Survey: McDermitt, Malheur Co., June 5, 1915, male (E. A. Preble); Rome, Owyhee River, female without date label (E. A. Preble).

Lately Mr. L. P. Rockwood sent me for examination five males and one female collected at Baker City, June 17, 18 and 24, 1917, which have very dark colored bodies, the tergum showing but little red on the edges of the segments at the sides, the basal cell is nearly black; the anal membranes are vermilion and the costal margin of the fore wings is bright orange to the end of the radial cell. He also sent to me two males and a female collected by C. W. Creel, at Paisley, Lake Co., south central Oregon, on the borders of Chewaucan Marsh.

Washington.—Ephrata, Douglas Co., June 21, 1918, female (A. C. Burrill), collection U. S. Entomological Station, Forest Grove, Oregon.

Alberta.—Jasper, July 4, 1915, two males, collection Cornell University and Davis collection.

British Columbia.—Male without any date labeled "Brit. Col. (G. W. Taylor)," Davis collection. Eillooet, July 6, 1918, male (A. B. Baird), Baird collection.

Okanagana rimosa (Say). Pl. xx, fig. 2.

1830. *Cicada rimosa* Say, Jl. Acad. Nat. Sci., Phila., vi, p. 235.
1854. *Cicada noveboracensis* Emmons, Nat. Hist. N. Y. Ins., p. 152, pl. 9, fig. 6.

The principal characters given in the original description are: "Body black above, . . . a rufus spot over the antennæ; thorax obsoletely varied each side with piceus; posterior and lateral edges rufus: scutel with the elevated cruciform line, two spots before it, and two or three on each side rufus: . . . tergum, posterior edges of the segments rufus: beneath rufus, varied with black: . . . length to the tip of the hemelytra one inch and one-fourth." Say further adds: "Mr. Nuttall presented me two specimens, which he obtained on the Missouri, and I found one on the Arkansaw"; also: "On the prominent middle of the hypostoma is a very obvious impressed line."

The insect which he collected "on the Arkansaw," when he was with Major Long's expedition to the Rocky Mountains in 1819–1820, may not have been the same species as the two specimens mentioned first in the description and given to him by Nuttall, who obtained them along the Missouri River.

It next becomes important to ascertain, if possible, from what locality the type specimens of *Cicada rimosa* were obtained, and I have been to some pains to look up the original authorities. As an aid to this Dr. N. L. Britton, of the New York Botanical Garden, has sent to me some notes by Dr. P. A. Rydberg on the three journeys made by Thomas Nuttall, the botanist, to regions west of the Mississippi. It was on the first of these, namely in 1811, or Astoria expedition, that he collected the two specimens referred to, for the very good reason that in the second expedition of 1819–1820, he went along the Arkansas River, and did not touch the Missouri; and the third expedition started in 1834 after *Cicada rimosa* had been described.

John Bradbury, another botanist, was with the Astoria expedition, and in 1817 he published in London, England, a narrative of his travels in the interior of America. He and Nuttall accompanied Mr. Hunt from St. Louis up the Missouri as far as the Arickara Indian

village in the north central part of the present South Dakota, and in late June they both went about 150 miles still further north to the Mandan Indian village close to the site of the present city of Bismark in North Dakota, where they stayed for a few days before returning to the Arickara village. In Bradbury's account we read on page 226 the following from Mr. Cook's narrative of Mr. Hunt's expedition from the Aricaras to the Pacific. "Messrs. Hunt, Crooks, Miller, M'Clellan, M'Kenzie, and about sixty men, who left St. Louis in the beginning of March, 1811, for the Pacific Ocean, reached the Aricara village on the thirteenth day of June. . . ." Mr. Crooks was one of the partners and we quote his statement to show, among other things, that it was 1811 and not in 1810, as has sometimes been stated, that the Astoria party ascended the Missouri. From reading Irving's account one might easily get the impression that it was in 1810.

Irving in his Astoria says: "On the 18 of July Mr. Hunt took up his line of march by land from the Arickara village leaving Mr. Lisa and Mr. Nuttall there where they intended to await the expected arrival of Mr. Henry from the Rocky Mountains. As to Messrs. Bradbury and Breckenridge they had departed some days previously on a voyage down the river to St. Louis, with a detachment from Mr. Lisa's party."

Mr. Bradbury records that he started on July 17, and it took him until the end of July, or slightly longer, to reach St. Louis, and on page 193 he further states that Mr. Lisa with whom Nuttall had remained, arrived in St. Louis in November.

From the foregoing it will be seen that *Cicada rimosa* was no doubt taken close to the Missouri River in what is now North or South Dakota, for Mr. Nuttall did not arrive at the Aricara village until about the time the species of *Okanagana* emerge, and allowing him a month or more to reach St. Louis, he left the Indian village after their season was over.

We now know that there are several species of *Okanagana* that resemble *rimosa* and may be mistaken for it, but having located Mr. Nuttall's whereabouts in June, July, August and September, 1811, covering the time of emergence of these insects, we can more certainly identify the species by our examination of specimens from the same region. This has been done and a male collected at Sioux City

on the Missouri by A. W. Lindsey, and presented to me by Prof. H. F. Wickham, has been identified as *Okanagana rimosa.* This insect fits Say's description in every particular. The uncus is slightly more pinched or ridged on the dorsum, also the cleft at the extremity is somewhat deeper than in the males of *Okanagana novcboracensis* (Emmons) from New York and Maine, but in other particulars it appears to be the same. It is probable therefore that *novcborascensis* is the same as *rimosa,* certainly not more than a variety.

The fore wings in *rimosa* and *canadensis* (Provancher) are proportionately narrower than in any of the other species considered and in this particular the two Okanaganas that extend to the northeastern United States and eastern Canada, can thus be separated from the more western forms, *tristis* Van Duzee, excepted.

In addition to the Sioux City example already referred to, the following specimens have been examined:

Minnesota.—Itasca, July, 1908, female, and male and female labeled simply "Minnesota," collection University of Minnesota.

Wisconsin.—Bayfield, female (Prof. H. F. Wickham), Davis collection.

Manitoba.—Aweme, June 19, 1917, two males (N. Criddle), Davis collection. Treesbank, July 7, 1907, male, and June 11, 1914, male (N. Criddle), Davis collection.

Ontario.—Toronto, June 19, 1896, female, collection Dr. E. D. Ball.

Illinois.—Ogle Co., male (Uhler collection), U. S. Nat. Museum.

Quebec.—Kazubazua, Ottawa District, July, 1917, male, collection C. B. Gooderham.

Pennsylvania.—Cresco, Monroe Co., June 9, 1918, female (J. N. Knull), Davis collection. Echo Lake, Pike Co., July 8, 1910 (E. Shoemaker), Davis collection.

New York.—Ithaca, July 25, 1916, female, and August 1, 1916, male, collection Cornell University. Windsor, Broome Co., June 5, 1918, female, and June 7, 1918, female (Notman), Howard Notman collection. Wilmington, Essex Co., July 12, 1914, male (Davis), Davis collection. Rockaway Beach, Long Island in wash-up, June 26, 1909, female (Geo. P. Engelhardt), collection Museum Brooklyn Institute Arts and Sciences, and June 14, 1914, female (Ernest Shoemaker), Davis collection.

Massachusetts.—North Saugas, July 8, 1907, male (D. H. Clemmons), U. S. Nat. Museum. Melrose Highlands, June 4, 1911, two males (H. E. Smith), U. S. National Museum. Medford, male (J. H. Rogers), Boston Soc. Natural History. Lawrence, male (J. O. Treat), Boston Soc. Natural History. Concord, June 25, 1854, male, Harris collection, and June 17, 1914, male (W. Reiff), Boston Soc. Natural History.

New Hampshire.—Chocorua, August 12, 1917 (Linder), Boston Soc. Natural History.

Maine.—Cumberland Co., July 11, 1916, male and female, and July 12, 1916, two males (A. S. Nicolay), Davis collection. Brunswick, male (A. S. Packard), Boston Society Natural History. Hampden, July 10, 1907, two males (C. W. Johnson), Davis collection. Orono, July 13, 1906, male, July 31, 1906, male, and July 18, 1913, female, collection Me. Agri. Exp. Station. Harrington, June, 1908, Boston Soc. Natural History. Columbia, July 8, 1912, two males, three females (S. F. Blake), Davis collection; July 3, 1912, male and female, and July 8, 1912, male and three females (S. F. Blake), Boston Soc. Natural History.

Nova Scotia.—Truro, July 5, 1913, male (L. G. Saunders), Saunders collection.

The song of this species continues for some time and somewhat resembles the sound produced by *Neoconocephalus retusus* or *N. robustus,* two of the large, long-horned katydid-like insects. Though we have not been able to collect them, we have heard cicadas of the genus *Okanagana* singing on Crow's Nest Mt., West Point, N. Y., on June 15, 1913, and again on June 13, 1914, and Col. Wirt Robinson collected a pupa-skin on the same mountain. We have also heard them singing in Letchworth Park, Portage, N. Y., June 13, 1915; near Potter's Swamp, Yates Co., N. Y., June 14, 1915, and in Egleston's Glen on the east side of Lake Keuka, N. Y., June 15, 1915.

Okanagana canadensis (Provancher). Pl. xx, fig. 3.

1889. Petite Faune Entomologique du Canada, iii, p. 213.

This name is placed by most authors as a synonym of *rimosa,* but we think incorrectly. *Okanagana canadensis* on the whole is a larger species than *rimosa;* it is also blacker with the upper portions especially the tergum adorned with much tomentum, different from the

vestiture of *rimosa*. While the pronotum is usually black edged posteriorly with testaceous, there are occasional specimens in which it is mottled each side with testaceous.

I am indebted to Prof. L. M. Stöhr of Ironside, Quebec, for a long series of this species. On June 21, 1916, he collected a male; in 1917 he collected in all 39 specimens as follows: June 22, 2 males; June 23, 4 males; June 24, 3 males; June 26, 3 males; June 27, 6 males; June 28, 7 males; July 2, male; July 19, male and female; July 22, female; July 26, 5 males, 1 female; July 28, 2 males; July 30, male, and Aug. 15, female. In 1918 he collected ten specimens as follows: June 14, male; June 15, male; June 19, 3 males; June 20, female; June 25, 2 males; July 30, male; July 31, male. In June, 1919, he collected eighteen males and five females. These insects are alike and very black in appearance with the venation of the front wings somewhat thickened. When the wings are closed they show the narrow testaceous hind border of the pronotum, a spot each side at the base of the fore wings, four spots arranged in a semi-circle in front of the $\times$, and the higher parts of the $\times$ itself usually touched with testaceous.

Prof. Stöhr writes as follows concerning this species: "It is almost exclusively on pines; I have heard it, however, on cedar trees, and in two instances on willows. Usually it perches at the very extremity of the trees, often only a few inches below the terminal bud, or at the end of the branches. In order to begin the hunting one moves toward the cluster of trees from whence the song seems to proceed. It is, however, difficult to take one's bearings for the noise now seems to come from the left and now from the right. Conditions still get worse when the suspicious insect suddenly stops its song while one is looking his eyes out in order to locate it, and absolute silence follows the loud clamour. If one has not ascertained with certainty the exact position of the insect, he might better try his luck elsewhere, if he does not want to take too many chances. Once a tree found on which an *Okanagana* sits, the ascent begins. When the song has not stopped before, invariably it ceases then, and from the top of the pine one has no other resource than to inspect branch by branch and with good luck one may thus detect the Cicada perched on a twig, the dark color of the bark making it diffi-

cult to distinguish the insect. After ten minutes or more of silence it flaps its wings spasmodically and accompanies the manœuvre with a low rattling sound; after that the song starts monotonous and strident." The cicadas commence to sing about 9 in the morning and continue until about 5 o'clock in the afternoon or even later. In catching the insects Prof. Stöhr states that he got the best results by enveloping his hand with a net used for taking minnows, the narrow meshes of which would coop up the cicada and prevent it from slipping through the fingers.

In addition to those already mentioned the following specimens of *canadensis* have been examined: Sudbury, Ontario, 1893, female, Davis collection; Hymers, Ontario, June 26, 1913, male, and male without date (H. Dawson), Davis collection; Nipigon, Ontario, July 9, 1907, male and female (Dr. Skinner), Academy Nat. Sci. Philadelphia. Niagara Falls, N. Y., female, Am. Museum Nat. History; Schoharie, Schoharie Co., N. Y., June 14, 1918, male (H. Notman), Notman collection; Enfield Falls, N. Y., August 3, 1901, collection University of Minnesota. Charter Oak, Huntingdon Co., Pa., July 11, 1917, male and female (J. N. Knull), Davis collection. Through the kindness of Prof. F. M. Gaige, we have been able to examine the following from the collection of the University of Michigan: Porcupine Mts., Upper Michigan, Aug. 13, 1904, male (A. G. Ruthven); Isle Royale, Michigan, 1878, three males.

Okanagana tristis Van Duzee.

1915. Journal N. Y. Ento. Soc., xxiii, pp. 26, 35.

In the original description based on specimens from Northern California it is stated that, "The elongated form, somber black color and fulvous venter will distinguish this form." It is also quite a large insect. As in *occidentalis* the notch in the last ventral segment of the female is double, but in addition to being differently colored, it is larger than *occidentalis* and has narrower wings.

Specimens have been examined as follows:

California.—Dunsmuir, July 20, three males (Dyar and Caudell), U. S. Nat. Museum; Keddie, Plumas Co., 3,500 ft., June 29, 1918, female and July 7, 1918, female (F. M. Jones), Davis collection; Plumas Co., June 16, 1913, male (Nunenmacher), Davis collection; Eldridge, Sonoma Co., paratype, female, Davis collection; Eldridge,

male, Davis collection; Sonoma Co., female, Davis collection; Trinity Co., June 6, 1917, female (E. R. Leach); Santa Cruz Co., July, 1917, male (E. R. Leach), Davis collection.

Oregon.—Josephine Co., June 8, 1910, female, and June 9, 1910, male (Nunenmacher), Davis collection.

Washington.—Near Mt. Rainier, August 25, 1916, female (J. A. Kuche), Davis collection.

Okanagana arctostaphylæ Van Duzee.

1915. Journal N. Y. Ento. Soc., xxiii, pp. 26, 34.

This species was described from four males and one female from Calaveras Co., Calif., 1,800 ft., collected by Dr. F. E. Blaisdell. One of the male cotypes is now in the U. S. National Museum, and one in the writer's collection.

The uncus is not hooked at the extremity and so for convenience in identification the insect is considered here, but it and *rubrovenosa,* which has a hooked uncus, closely resembles each other. They are also both rather slender bodied insects. The color of the basal cell, costal margin, veins and membranes, is dull red in both species. In *arctostaphylæ,* however, the body is not as black as in *rubrovenosa;* it has a black band connecting the eyes; a black irregular spot behind the ocelli; sides of the pronotum blackened; collar of the same reddish color as the central part of pronotum; abdomen with a black dorsal vitta, broadest at the base.

Okanagana canescens Van Duzee.

1915. Journal N. Y. Ento. Soc., xxiii, pp. 26, 37.

The male type of this species came from Sonoma Co., Calif., July 14, 1908, and is in the collection of Dr. F. E. Blaisdell. Mr. Van Duzee also had a female from the Bay region of California when he wrote his description.

To these records we can add the following all from California. A male labeled "California," Am. Museum Natural History; Chico, two males (Dr. E. D. Ball); Alameda, July 12, 1911, male (Nunenmacher), Davis collection; Palo Alto, three males (C. H. Kennedy), Davis collection; Merced Co., two males, June 19, 1914, Davis collection. One of the males from Merced Co., and one from Palo Alto, have been examined by Mr. Van Duzee. In the U. S. National Mu-

seum there is a male from Santa Cruz Mts., Calif., that appears to belong to this species. It bears a label "New to Uhler, 1893." The lighter colors on the head, pronotum and mesonotum are much more extended than usual. The tergum is black; the uncus is the same as in *canescens*.

Okanagana viridis Davis.

1918. Journal N. Y. Ento. Soc., xxvi, p. 153, pl. 8, figs. 4–5.

This species was described from a male and female from O'Reilly, Mississippi, and so far they are the only specimens known. Its green color and size will serve at the present time to separate this remarkable insect from the other species of the genus.

Okanagana aurantiaca Davis.

1917. Journal N. Y. Ento. Soc., xxv, p. 9, pl. 2, fig. 4.

The three males and one female from which this orange and black species was described are supposed to have come from Lower California, Mexico. No additional specimens have been seen.

Okanagana fratercula Davis.

1915. Journal N. Y. Ento. Soc., xxiii, p. 20, pl. 3, fig. 5.

This was described from a single male in the collection of the Museum of the Brooklyn Institute of Arts and Sciences, from Iron Co., Utah. The following are additional records: Kolb Mts., Washington Co., Utah, 8,500 ft., June 30, 1917, male (George P. Engelhardt), Davis collection; Nephi, Utah, June 25, 1912, male (Dr. E. D. Ball), Davis collection; Blackfoot, Idaho, June 22, 1904, male (E. S. G. Titus), U. S. National Museum; Springfield, Idaho, July 24, male and female (H. Skinner), Acad. Natural Sciences, Philadelphia; Reno, Nevada, June 6, 1909, two males (Dr. E. D. Ball), Davis collection; Iron Springs, Cedar City, Iron Co., Utah, June 26, 1919, 5,750 ft., three males and twelve females (T. Spalding); Coal Creek, Iron Co., Utah, June 27, 1919, male (T. Spalding), Davis collection. The specimens from Nevada and Iron Co., Utah, may belong to a distinct and larger species with wing expanse as great as 65 mm. They have the front wings beautifully colored. The veins surrounding the marginal cells and first ulnar cell, are very dark, the remaining veins are bright yellow, and the basal cells is blackened. The tergum is blacker than in typical *fratercula*, segments seven and eight being the only

ones edged with orange on dorsum; valve yellow. The female from Springfield mentioned above is like the male type with which it has been compared, except that it expands 58 mm. instead of 46. The shape of the head and colors are the same. The last ventral segment shows a slight indication of a double notch.

Okanagana oregona Davis.

1916. Journal N. Y. Ento. Soc., xxiv, p. 233, pl. 11, fig. 1.

The original description was from the type, allotype, and thirteen other specimen, all from Oregon. Additional records are: Wren, Oregon, July 4, 1905, male; East Toll Gate, Oregon, July 15, 1906, female, and Mayville, Oregon, July 15, male, all from Prof. A. L. Lovett, and in the collection of the Oregon Agri. College. Mt. Moscow, Latah Co., Idaho, 5,000 ft., two males (T. Magee), from Prof. A. C. Burrill, Univ. of Idaho. Bridger Canyon, Gallatin Co., Montana, July 7, 1904, female, from Prof. R. A. Cooley, and in the collection of the Montana Agri. Experiment Station.

The venation in the wings of this small species is yellowish in color, and the wings are proportionately narrower than in the preceding species.

Okanagana triangulata Davis.

1915. Journal N. Y. Ento. Soc., xxiii, p. 14, pl. 3, fig. 7.

This species was described from a male collected in Mendocino Co., California, and a female in the collection of the American Museum of Natural History from Angel Island near San Francisco was cited as probably of the same species. Mr. G. R. Pilate has sent to me from Olancha, Inyo Co., California, 88 males and 84 females collected June 25, 1917, that agree with the type. They were very numerous at that time on the grass of the Olancha meadows, and Mr. Pilate states that his fingers became quite sticky from some alkaline substance that adhered to the insects as they crawled from the soil. While this species and *oregona* resemble each other, they may be separated by the characters given in the table, which appear to be constant for the long series examined. Four males have recently been received from Ukiah, Mendocino Co., California, May, 1919 (E. P. Hewlett).

Okanagana synodica (Say).

1825. Journal Acad. Nat. Sci. Phil., iv, p. 334.

There is no other described *Okanagana* that closely resembles this narrow bodied, small-headed, yellow and black species, which Say recorded as inhabiting the base of the Rocky Mountains. It has a much greater distribution than has heretofore been given. The following specimens have been examined:

Montana.—Livingston, July 31, 1905, three males; Miles City, July 11, 1915, male, all from collection Montana Agri. Exp. Station.

Nebraska.—Squaw Canyon, Sioux Co., July 20, 1892, three males; War Bonnet Canyon, eight males, ten females; Bad Lands north of Monroe Canyon, Sioux Co., July, on sage, five males (M. A. Carriker, Jr.), and male and female, June 21, 1911 (R. W. Dawson); Big Spring, June 29, 1912, eight males (E. M. Harrison). All Nebraska records from collection University of Nebraska.

Kansas.—Hamilton Co., 3,350 ft., five males (F. H. Snow); Rush Co., 2,060 ft., June 29, 1912 male (F. X. Williams), and Trego Co., 2,450 ft., July 12, 1912, male (F. X. Williams), collection University of Kansas. In the collection of Purdue University there are two females and a male labeled Kansas, and in the Academy Nat. Sciences, Philadelphia, two examples without date.

Colorado.—Denver, May, male; six males and a female without date, and a male labeled "on prairie around Denver, Col., May" (Oslar), Davis collection. Ft. Collins, male (Pergande and S. Henshaw), Mus. of Comparative Zoölogy, Cambridge, Mass. Ft. Collins, June 18, 1900, two males; Pueblo, June 15, 1900, male, and Larmar, June 17, 1900, three females, collection Dr. E. D. Ball. Salida, July 2, 1885, three males and three females, and four males, 1885, collection University of Nebraska.

New Mexico.—Female labeled "New Mex.," Davis collection. Male labeled "New Mex." Museum of Comparative Zoölogy, Cambridge, Mass. Sandia Mts., N. M., male, collection Florida Agri. Exp. Sta.

Texas.—Tascosa, June 1, 1918, male (Miss M. McGill), Davis collection.

Okanagana balli new species. Pl. xx, fig. 5.

Type male from Little Rock, Iowa (Dr. E. D. Ball), and allotype female from same locality. Davis collection.

This is a small species a little larger than *synodica,* with the wings not qutie as transparent as usual, which is also the case in *synodica.*

Head not quite as broad as the front margin of the pronotum; front rather prominent. Median sulcus of the front well defined. Pronotum with the humeral angles rounded and the anterior angles rather prominent. Last ventral segment with the base about as long as the sides, which gradually converge to the truncate extremity. Uncus when viewed in profile sinuated

but not hooked at the end; when viewed from above evenly curved and narrowed to the extremity which is notched. The last ventral segment in the female allotype is doubly notched. Venation of both pairs of wings yellowish, the costal margin of the fore wings a little darker beyond the radial cell; basal cell yellowish and translucent. The membranes at the base of both pairs of wings are orange-red in color. Dorsum partly clothed with short golden hairs especially on the abdomen along the posterior margin of the segments; beneath the pubescence is short. Head black with all of the grooves and supra-antennal plates testaceous, beneath black in the region of the transverse rugæ, which are margined with testaceous; rostrum pale at base. Pronotum black variegated each side, especially in the grooves with pale, and margined all around, except for a short space at humeral angles with testaceous. Mesonotum black, with the hind margin, the elevated ×, two spots at the anterior extremities of the ×, and the posterior part of the W-mark, testaceous. Metanotum black, posteriorly margined with testaceous. Tergum black, the segments narrowly edged posteriorly with testaceous. Uncus black with a dorsal pale stripe. Beneath pale, including the valve; the usual black spot at the base of the abdomen; legs pale, femora darkened.

MEASUREMENTS IN MILLIMETERS.

	Male Type.	Female Allotype.
Length of body	19.5	20
Width of head across eyes	6	6
Expanse of fore wings	47	51
Length of valve	4	

Okanagana balli looks something like a small *rimosa,* but is more yellow in color, and the transverse fold crossing the fore wings at the node is sometimes developed, as it is in *synodica.*

The first specimen I examined of this species came from Dr. O. S. Westcott, Oak Park, Ill., but was without locality or date label. In the U. S. National Museum there is a female labeled Winona, Minn., and in the Uhler collection in the same museum, there is a male from Greene Co., Iowa, labeled "Tibicen n. sp., Stal." In Prof. Albert P. Morse's collection there is a male labeled Little Rock, Iowa, and Dr. E. D. Ball has sent to me fifteen males and one female from Little Rock, Iowa. It is evident that at the time they were collected they appeared as a swarm, but unfortunately they bear no date. In the collection of the University of Minnesota there is a male labeled Rock Co., Minn., June 24, 1910, and four other males without locality labels. In the collection of the South Dakota State College, there are five males and two females labeled Brookings, S. D., and a male and female labeled S. D. These and the specimens mentioned above closely resemble one another in size and markings.

Okanagana rubrovenosa Davis.

1915. Journal N. Y. Ento. Soc., xxiii, p. 11, pl. 3, fig. 1.

The following records are additional to those given in the original description: Sonoma Co., Calif., July 4, male (O. Sack), U. S. Nat. Museum. The label further states, "Its note is continuous (not intermittent) and not loud. It resembles the whirring of a bee in confinement." Hullville, Lake Co., Calif., June 13, 1917, two males, three females (Dr. F. E. Blaisdell). Ukiah, Calif., May, 1919, three males (E. P. Hewlett). Keddie, Plumas Co., Calif., 3,500 ft., June 24, 1918, two males, and June 28, 1918, male and female (Frank M. Jones). In transmitting these specimens and a twig in which a cicada had oviposited, Mr. Jones writes: "The red cicada, of which there are four examples, was locally abundant and in constant song in the manzanita bushes, and the manzanita twig showing egg-deposit almost certainly belongs to this species, though I did not see the female at work."

The female of this beautiful insect has never been described. The one collected by Mr. Jones expands 64 millimeters and is of the same color as the type; the body black above covered with short reddish

hairs, which gives it a rusty appearance. The tergum is black where denuded of hair. Beneath the abdomen is densely clothed with hair, black in color with the hind margin of the segments dark red. The notch in the last ventral segment is double. There are the same patches of silvery hairs at the base of the fore wings as in the type. The three females received from Dr. Blaisdell are like the one just described, except that they are a little smaller.

Okanagana vanduzeei Distant.

1914. Ann. Mag. Nat. Hist., ser. 8, xiv, p. 165.
1914. *a.* var. *consobrina* Distant. Ann. Mag. Nat. Hist., ser. 8, xiv, p. 165.
1914. *b.* var. *californica* Distant. Ann. Mag. Nat. Hist., ser. 8, xiv, p. 166.

The type locality for *vanduzeei* and what are here considered as two varieties of that species, is San Diego Co., California.

Through the kindness of Prof. Wm. S. Wright I have received 86 males and 9 females of *vanduzeei;* 25 males and 12 females of var. *consobrina* and 2 males of var. *californica* collected at Dulzura, San Diego Co., Calif., from June 12 to 25, 1917. Prof. Wright considered that he had collected in this long series but one species, and describes its song as follows: "It is low, long continued and sweet. They will sing for nearly half an hour without a quaver; they usually are to be found setting high up in the brush, seldom in the trees."

In addition to the specimens already mentioned the following have been examined, and unless otherwise stated they are in the writer's collection.

San Diego, Calif., May 6, 1916, twelve males, two females (Prof. Wm. S. Wright); San Diego, Calif., June 25, 1914, two males determined as *vanduzeei* and collected by Mr. Van Duzee; Santa Catalina Island, June, 1917, male; Santa Rosa Island, male, collection Am. Museum Nat. History; Los Angeles, Calif., June 10, 1916, male (A. C. Davis); San Jose, Calif., July 4, four males (King), collection Dr. E. D. Ball; Alameda Co., Calif., June 29, 1914, nine males, June 30, 1914, thirty-four males and two females (F. W. Nunenmacher); Piedmont, Alameda Co., Calif., July 22, 1912, two males, May 18, 1917, male, and July 2, 1917, eight males (Nunenmacher); Contra Costa Co., Calif., June, male; Keddie, Plumas Co., Calif., 3,500 ft., June 26, 1918, male (F. M. Jones); Oroville, Calif., July 24, 1912, male (E. D. Ball), collection Dr. Ball; Lassen Co., Calif., June 5,

1913, female (Nunenmacher); Twin Falls, Snake River Canyon, Idaho, July 6, 1917, female (Mrs. A. C. Burrill). Mr. Van Duzee has recorded this species as far north as Mt. Rainier, Washington.

Mr. E. R. Leach has sent to me the following specimens of a small form of *vanduzeei* expanding from 50 to 55 millimeters: Trinity Co., Calif., July 18, 1917, two males, one female, and June 17, 1918, two females.

Of variety *consobina* the following have been examined: San Diego Co., Calif., May 22, 1914, three males; May 23, 1914, one male; May 24, 1914, two males (E. P. Van Duzee). La Jolla, San Diego Co., Calif., June, 1916, six males and a female; August 1, 1917, one male (Geo. P. Engelhardt). Santa Monica, Los Angeles Co., Calif., May 28, 1916, male and two females (A. C. Davis), Los Angeles Co., Calif., July 8, 1916, male; Pasadena, Calif., July, 1917, male, and May, 1918, two males (Alonzo C. Davis). Santa Barbara, July 7, 1907, two males (Prof. Jas. S. Hine); San Jose, Calif., July 4, two males, one female (King), collection Dr. E. D. Ball; Polo Alto, Calif., male (C. H. Kennedy); Whitebird, Idaho, June 28, 1907, female (Dr. J. M. Aldrich). Two of the San Diego specimens have been identified as *consobrina* by Mr. Van Duzee, and several of the seven individuals from La Jolla approach typical *vanduzeei*.

Of variety *californica* the following have been examined: San Diego Co., Calif., July 9, 1913, male, collected and determined by Mr. Van Duzee; July 12, 1913, eight males; Aug. 3, 1913, one male (Prof. W. S. Wright); August, male, came to light. Pasadena, Calif., July 2, 1917, male (A. C. Davis).

In the JOURNAL OF THE N. Y. ENTO. SOC., March, 1915, Mr. Van Duzee suggests that *californica* may be a variety of *vanduzeei*, rather than a separate species as originally described.

Okanagana striatipes (Haldeman).

1852. Stansbury's Exploration and Survey of the Valley of the Great Salt Lake of Utah, p. 369, pl. 9, fig. 16.

No definite type locality is mentioned by Haldeman in the original description, which calls for an insect expanding 52 millimeters, with a prominent face; beneath yellow, end of rostrum, a few points near the joints of the feet and a transverse line at the base of the abdomen, black. The tergum is black with the margins of the segments yellow.

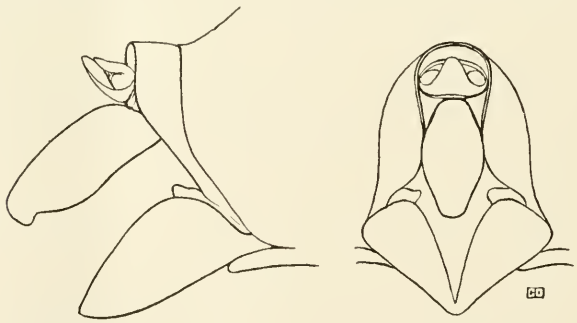
This is not an uncommon species in Utah, and neighboring states, and the following specimens have been examined: Honeyville, Box-elder Co., Utah, 1907, female (E. G. Titus), and Logan, Cache Co., Utah, July 13, 1907, male, collection Dr. E. D. Ball. Promontory Pt., Great Salt Lake, Utah, July 11, 1911, male (Dr. J. M. Aldrich), collection University of Idaho; Salt Lake City, Utah, male (Dr. Henry Skinner), Acad. Nat. Sci. Philadelphia; Stockton, Utah, July, 1913, two males; July, 1914, four males; July, 1915, female; Sept. 2, 1916, four males, all collected by Tom Spalding and in Davis collection. South Creek, Beaver Co., Utah, two males (Engelhardt), Davis collection. Cedar Creek, Iron Co., Utah, 5,500 ft., July 9, 1917, seven males (G. P. Engelhardt); Bellevue, Washington Co., Utah, 4,500 ft., June, 1917, and July 7, 1917 (G. P. Engelhardt), Davis collection. Kanab, Kane Co., Utah, June 24, 1913, two males, collection Dr. E. D. Ball. Flagstaff, Arizona, June 29, 1892, two males, Davis collection. In Mr. Van Duzee's Catalogue of Hemiptera, California and Oregon are also given as localities.

Okanagana utahensis new species. Pl. xx, fig. 4.

Type male from Cedar Creek, Iron Co., Utah, 5,500 ft., July 9, 1917 (Geo. P. Engelhardt), Davis collection.

Allotype female from Stockton, Utah, July, 1914 (Tom Spalding), Davis collection.

Resembles *striatipes,* but is larger and darker colored, and the



OKANAGANA UTAHENSIS

vestiture of the pronotum and mesonotum is not an appressed pubescence as in that species, but contains many long silvery hairs.

Head about as broad as the front margin of the pronotum; front more protruding than in most species of the genus; median sulcus well defined. Pronotum with the humeral angles rounded and the anterior angles prominent. Last ventral segment constricted at the sides, then broadened out to the extremity, which has the outer angles rounded and a sinus centrally. Uncus when viewed in profile hooked at the end; when viewed from behind, the book is seen to be notched. The last ventral segment in the female allotype is ratherly deeply notched. Venation of the fore wings testaceous, darker beyond the transverse fold. Costal margin of fore wing yellow to end radial cell, darker beyond; subcostal vein black, or nearly so in some of the paratypes; basal cell clouded, in some of the paratypes blackened; the vein (C2) on the inner side of the eighth marginal cell is usually light in color. Both pairs of wings variegated with black at base, with the membranes orange-red. Dorsum partly clothed with short silvery hairs, which are rather long in the cavities about the mesonotal ×; in *striatipes* the hairs are short about the × and more golden in color. Beneath the vestiture is abundant, but the hairs are not long. Head black with the grooves and supra-antennal plates testaceous; beneath with the median sulcus orange; the transverse rugæ black; rostrum black, orange at base. Pronotum black, the grooves testaceous; bordered all around with orange, but more narrowly on the anterior margin. Mesonotum black, with the hind margin orange; the elevated × orange, variegated with black, and four orange spots arranged in a semicircle in front of the ×. Metanotum black, posteriorly margined with orange. Tergum black the eighth and ninth segments margined posteriorly with orange. Uncus black; in some of the paratypes there is a dorsal pale stripe. Beneath, black, the legs pale striped with black, and each abdominal segment edged posteriorly and on the sides with orange. In the allotype and some of the paratypes the black is reduced to an interrupted stripe on the central part of the abdomen, with a black spot each side on the segments. Valve pale variegated with black.

MEASUREMENTS IN MILLIMETERS.

	Male Type.	Female Allotype.
Length of body	24.5	24
Width of head across eyes	8	8
Expanse of fore wings	60	64
Length of valve	3	

In addition to the type and allotype the following specimens have been examined, and unless otherwise stated, they are in the writer's collection.

Utah.—Logan, Cache Co., June 28, 1904, male, and male, July 13, 1907, collection Dr. E. D. Ball. Hyrum, Cache Co., July 27, 1904, two males, collection Dr. E. D. Ball. Wellsville, Cache Co., Utah,

July 3, 1904, male, collection Dr. E. D. Ball. Sandy, Salt Lake Co., Utah, July 3, 1908, collection Dr. E. D. Ball. Cedar Valley, Utah Co., Utah, male and female, collection Dr. E. D. Ball. Salt Lake City, June 13, 1897, male, Academy Nat. Sci. Philadelphia. Salt Lake City, two males and a female (Dr. H. Skinner), Acad. Nat. Sci. Philadelphia. City Creek Canyon, Salt Lake Co., July 4, male (Dr. H. Skinner), Acad. Nat. Sci. Philadelphia. Salt Lake, June 16, 1913, three males (L. P. Rockwood), Rockwood collection. Stockton, Tooele Co., July 21, 1913, female; July 31, 1913, female; July, 1914, two males, one female; September 2, 1916, two males and a female, all collected by Mr. Tom Spalding. Vineyard. Utah Co., Aug., 1917, two males, and July 2, 1918, male (Spalding). South Creek, Beaver Co., Utah, female (Engelhardt). Cedar Creek, Iron Co., 5,500 ft., July 9, 1917, two males (Engelhardt). Bucksk Valley, Iron Co., female (Engelhardt). St. George, Washington Co., two males (Engelhardt).

Arizona.—Tuba, June, 1913, six males and one female (Dwight Franklin).

Idaho.—Payette, Canyon Co., male (Vastal), and Glenn's Ferry, Elmore Co., 1904, two males (Ewing), collection Oregon Agri. College.

Oregon.—Heppner, Morrow Co., July 11, 1906, three males, July 14, 1907, male; July 22, 1907, two males, and a female, all collected by Nettie Currin, and in the collection of the Oregon Agri. College. Ontario, Malheur Co., Sept. 3, 1905, female (Mallett). Oakland, Douglas Co., July 21, 1917, female, collection Oregon Agri. College. Riddle, Douglas Co., June 18, male, collection Oregon Agri. College.

Washington.—Logie Creek, Yakima Co., June 16, 1916, two males (C. H. Kennedy). Of these two males Mr. Kennedy writes, "they are from sage bushes and are a true desert species. They have a long shrill call, are shy, and hard to approach."

Okanagana hesperia (Uhler).

1876. Bulletin U. S. Geological and Geographical Survey of the Territories, i, p. 342.

Uhler states that his type was collected in the vicinity of Denver City, Colorado, by C[yrus] Thomas.

This species has been placed in the same genus with *Tibicenoides*

cupro-sparsus (Uhler), but it has the marginal cells of the fore wings more nearly of the length of the ulner cells as in *Okanagana* generally, whereas in *Tibicinoides cupro-sparsus* the marginal cells are quite short. The following have been examined:

Colorado.—Denver, July 13, 1909, male; July 14, 1909, male, and July 16, 1909, three males (W. J. Gerhard), Davis collection. Denver, July 27, 1912, male, and June 10, 1913, female (Oslar), Davis collection. Golden, July, male and female (Oslar); July 18, 1909, male (W. J. Gerhard), Davis collection. Fort Collins, June 28, 1900, three males, and July 16, 1903, female, collection University of Kansas; June 28, 1900, three males, three females, and July 17, 1900, five males, collection Dr. E. D. Ball; July 16, 1903, male (Van Duzee), Davis collection. Platte Canyon, Jefferson Co., July, two males (Oslar), Davis collection. La Junta, Otero Co., two males (Oslar), Davis collection. Trinidad, Las Animas Co., July 15, 1910, female, and male and female without date (Oslar), Davis collection.

Kansas.—Trego Co., 2,450 ft., July 12, 1912, five males, one female; July 13, 1912, three males; July 17, 1912, male (F. X. Williams), collection University of Kansas.

New Mexico.—Albuquerque, male (Oslar); Silver City, male; Jemez Springs, 6,400 ft., June 28, 1918, male, June 24, 1919, female (John Woodgate), all in Davis collection.

Arizona.—Graham Mountains, July 7, 1914, male (E. G. Holt), collection U. S. Bureau of the Biological Survey.

Montana.—Billings, July 16, 1904, male; Custer, Aug. 1, 1912, male, and Miles City, July 1, 1915, three males, collection Montana Agri. Exp. Station.

Okanagana pallidula Davis.

1917. Journal N. Y. Ento. Soc., xxv, p. 213, pl. 13, fig. 8.

Only the type and nine paratypic males have been examined, all collected at Athlone, Merced Co., California, in July and August, 1917, by Alonzo C. Davis, as recorded in the original description.

Okanagana uncinata Van Duzee.

1915. Journal N. Y. Ento. Soc., xxiii, pp. 27, 41.
1917. Journal N. Y. Ento. Soc., xxv, pl. 13, fig. 7.

The type locality for this species is Orange Co., California. Mr. Van Duzee has kindly sent me the type for examination, and also given me a paratype.

Okanagana mercedita Davis.

1915. Journal N. Y. Ento. Soc., xxiii, p. 16, pl. 3, fig. 8.

Only the type, the allotype and 16 males and 14 females from Merced Co., California, June 18, 1914, have been examined.

The short marginal cells in the fore and hind wings of this species, also in *O. minuta* and *Tibicinoides cupreo-sparsus* suggest a close relationship, and we think that they will ultimately be associated in the same genus. The supplementary transverse vein at the node is also more developed in *mercedita* and *minuta* than in most species of *Okanagana,* though not quite as well defined as in *cupreo-sparsus,* the type of the genus *Tibicinoides.*

Okanagana minuta Davis.

1915. Journal N. Y. Ento. Soc., xxiii, p. 17, pl. 3, fig. 6.

The original description was based on the type and 11 paratypic males, all from Sanford University, California, May 26, 1914 (C. H. Kennedy), and a female, Fresno Co., California (J. C. Bradley). Mr. Alonzo C. Davis has sent me three males collected at Lebec, Kern Co., Calif., June, 1918.

Tibicinoides cupreo-sparsus (Uhler).

1889. Trans. Md. Acad. Sci., 1, p. 43.

This small, beautiful, black and red species has been included in the table as an aid to the identification of species, and as has already been stated, probably *Okanagana mercedita* and *O. minuta* should be transferred to the genus *Tibicinoides.* The types mentioned by Uhler were two females captured near Los Angeles, California, by D. W. Coquillett.

The following specimens are in the writer's collection, all from southern California: San Diego Co., May 6, 1914, two males, and May 24, 1914, three males (E. P. Van Duzee); San Diego, July, 1914, three males (Prof. W. S. Wright); La Jola, June 10, 1915, three males (B. B. Fulton); Dulzura, San Diego Co., June 13–21, 1917, twenty males (Prof. W. S. Wright). In the collection of Dr. E. D. Ball, there is a male collected at Ontario, San Bernardino Co., June 12, 1908.

In the Transactions of the San Diego Society of Natural History, Vol. 2, p. 48, November, 1914, Mr. Van Duzee comments on this species as follows: "This very pretty little species was abundant this

season from April 26th until nearly the first of June. It occurs almost exclusively on a certain fine tufted grass, probably a Poa, growing on the hillsides about La Jolla and up Mission Valley and adjacent canyons as far as the Old Mission and perhaps farther. The bright red on the base of the wings gives this species a lively appearance when spread. Like *hesperia* Uhler it has the basal one half of the elytra infuscated. It has a shrill but feeble note which is long continued and easy to locate, but can rarely be heard for more than one hundred feet."

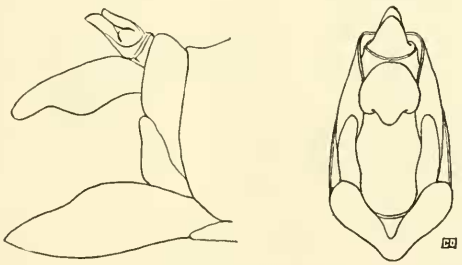
Okanagodes new genus.

In this genus the uncus is exposed as in *Okanagana* and the valve and wing venation are the same, but the pronotum is much narrower behind the eyes and the latter are exceedingly prominent. The front protrudes considerably and the supra-antennal plates are also prominent. The body is slim with the sides more parallel than in any known species of *Okanagana.* The type of the genus is the new species described below and figured on the accompanying plate.

Okanagodes gracilis new species. Pl. xx, fig. 6.

Type male and allotype female from Washington Co., Utah (Weidt). Davis collection.

A slim species the body in size about as in *Okanagana synodica,* but the



OKANAGODES GRACILIS

sides are more parallel and the wings are proportionately longer. Eyes vary prominent; fore part of pronotum considerably narrowed. The front is also very prominent with the median sulcus at first indistinct but lower down well developed; the supra-antennal plates are much enlarged. The result of these characters is to give the front of the head, when seen from above, a more uneven outline than in any *Okanagana* studied. The hook at the end of the

uncus is not much bent and it has no terminal notch. The opercula are small and the song apparatus plainly exposed. The comparatively few hairs on the underside of the abdomen are short and light colored; the last ventral segment is pubescent, constricted at the sides and rounded at the extremity. The insect is almost wholly straw-colored covered with a whitish pubescence; the eyes are darker and the ocelli are large and ruby colored. The transverse rugæ are darkened; there is an inverted V-shaped mark on the front between the supra-antennal plates. Pronotum with a dark-colored hour-glass-shaped spot centrally; the grooves darkened, and the posterior margin light-colored. Mesonotum with four cuneiform dark spots stretching backward from the anterior margin, the inner pair (the W-mark) not as long as the outer pair. A dark line extending from the base of each fore wing backward to the elevated ×; two small dark spots at the anterior extremities of the ×. Metanotum with a small dark elongate spot near the base of each hind wing and a more rounded one above each tympanum. Abdomen with the segments darkened at the base, but not on the sides. The costal margin of the fore wings straw-colored to the end of the radial cell, darkened beyond, the remaining veins and about the outer half of the wing also darkened. Basal cell clear. The anal membranes of the fore and hind wings are whitish, those of the hind wings include a clouded spot. Beneath there is a small elongate shining black spot each side near the base of the rostrum, which itself is blackened at the extremity. There is a dark spot at the base of each wing and dark lines at the base of the legs; the claws and spines of the legs also darkened. The usual dark spot centrally at the base of the abdomen. The allotype is colored as in the type except that there is a small dark spot at the side on each abdominal segment from the third to the seventh, and also a fainter one not in line with the others on segment eight. The notch in the last ventral segment is simple.

MEASUREMENTS IN MILLIMETERS.

	Male Type.	Female Allotype.
Length of body	19.5	20
Width of head across eyes	5	5.5
Expanse of fore wings	48	52
Length of valve	3	

In addition to the type and allotype another male and female from the same locality and without date, are in the writer's collection, as is also a male from Maricopa, Pinal Co., Arizona, July 3, 1918, collected by A. M. Gaudin. This last has the body almost wholly straw-colored and shows but faintly or not at all the darker marks described in the type. In the collection of the Bureau of the Biological Survey, U. S. Department of Agriculture, there are eighteen males and five females, collected at Higley, Arizona, July 17 to 25, 1917, by E. G.